

Study of Typical Signal in a Global Positioning System's Receiver

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Abstract: In the GPS satellite, signal can easily be disturbed by the objects in the surroundings of the receiver which can reduce the accuracy in the parameters of amplitude and phase of a signal at the receiver side. Due to this low accuracy, reflections will be occurred. These reflections causes multipath that can be occurred at the GPS receiver side, it is one of the major problem in GPS. Multipath is nothing but the signal that reaches the receiving side other then the straight line by two or more paths. To estimate the multipath error, Signal to Noise Ratio (SNR) is used at the GPS receiver. In this, MUSIC algorithm also used to calculate the multipath parameters (amplitude and phase). We estimate the errors occurred due to multipath is further used to improved GPS signal precession.

Key words: Global Positioning System (GPS), MUSIC, multipath, Signal to Noise Ratio (SNR), signal quality, reflections

INTRODUCTION

Global Positioning System (GPS) is a network of orbiting satellite that sends signals from space to earth (Bilich and Larson, 2007). The signals are obtained by GPS receivers such as navigation devices and are used to calculate the exact position, speed and time (Christopher and Axelrad, 1996; Comp and Axelrad, 1998). The major problem in GPS is multipath that causes delays, distortion, effects on multipath parameters (amplitude and phase) and low accuracy of GPS positioning (Naha *et al.*, 2015).

Multipath errors are dynamic in nature that changes according to the environmental conditions (Naha *et al.*, 2015). Previous techniques to reduce the multipath effect at receiver are receiver antenna design, reflectors design, filter design (Bilich *et al.*, 2008). All these methods describes the physical designing processes that varies according to multipath effect which is dynamic in nature (Rost and Wanninger, 2009). Here, signals and data processing techniques as signal quality measurement. Is used for the estimation of the carrier phase multipath error. Signal to Noise Ratio (SNR) of the received signal is used for calculating the error. This method increases accuracy when compared to the previous methods. Many former papers described polynomial fitting techniques that uses polynomial of degree 5-10 to separate direct signal from multipath signal but use of higher degree polynomial that is above 4th degree is unstable and widely diverges outside the range. To overcome the

above limitations, this study relies on the Multiple Signal Classification (MUSIC) algorithm used for the estimation of the composite signals amplitude at frequencies. Here, the composite signal consists of both direct and indirect signal amplitude (Sid *et al.*, 2017).

MATERIALS AND METHODS

MUSIC: This method is used for estimation of Direction of Arrival (DOA). MUSIC stands for Multiple Signal Classification. The MUSIC method is relatively simple and efficient eigen structure of DOA estimation. The MUSIC algorithm can be evaluated in the software is called as MATLAB.

MUSIC deals with the decomposition of correlation matrix into orthogonal matrix, signal-subspace and noise-subspace (Fig. 1 and 2).

Phase multipath: The way of direction in the many directions to send the transmitter side to receiver side. Then the multipath can be occurred at the GPS receiver end. The multipath is occurred then we have to observe the contents. Those contents are: azimuthal angle, elevation angle, time period and frequency.

The GPS (satellite) is send the information to ground. In multi way then noise to be added to the original signal to estimate the signal-to-noise ratio.

Global positioning system: It is a global navigation satellite system that provides geo location and time

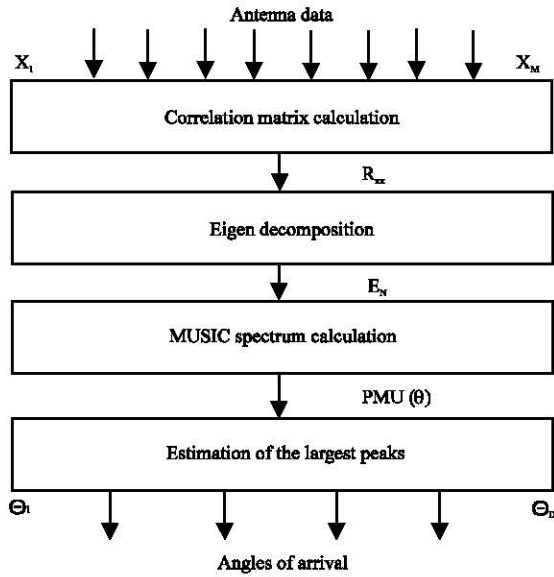


Fig. 1: Algorithm of proposed module

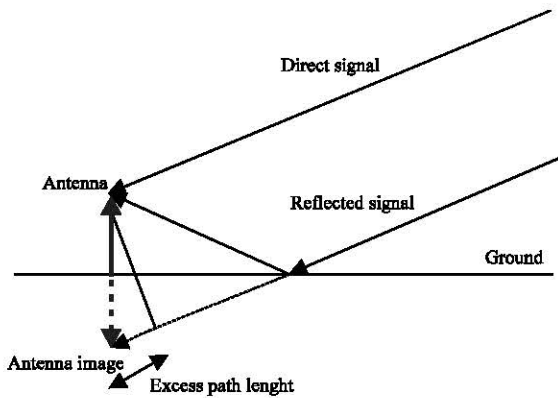


Fig. 2: Multipath phenomenon

information to a GPS receiver any where on or near the earth. The GPS system does not require the user to transmit any data and it operates independently of any telephonic or internet reception. The GPS system provides critical positioning capabilities to military, civil and commercial users around the world. In the GPS, we have to send the information to the destination then the multipaths will occur.

RESULTS AND DISCUSSION

After the simulation of the satellite data by using RTK software we got the values of azimuthal, elevation, locktime and CMC average values. These values are stored in the form of excel sheet. We read these excel sheet values in MATLAB Software. Some plots were obtained as Fig. 3-5.

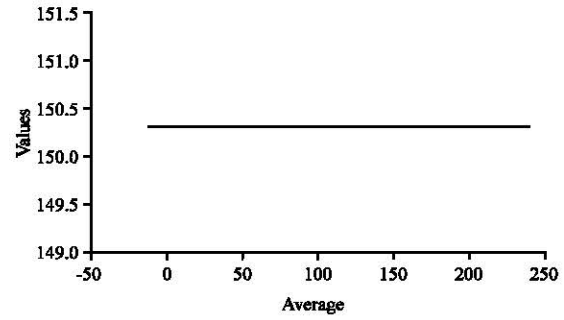


Fig. 3: Azimuthal vs. CMC average

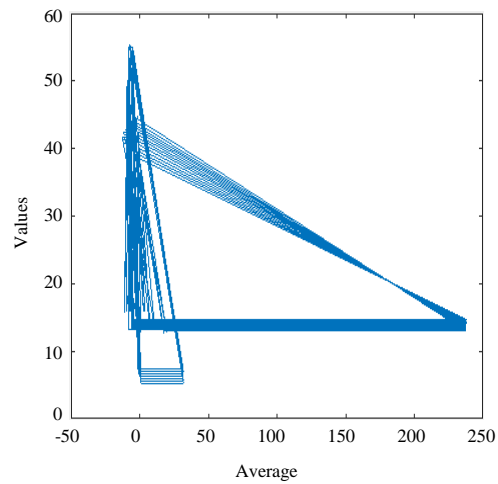


Fig. 4: Elevation vs. CMC average

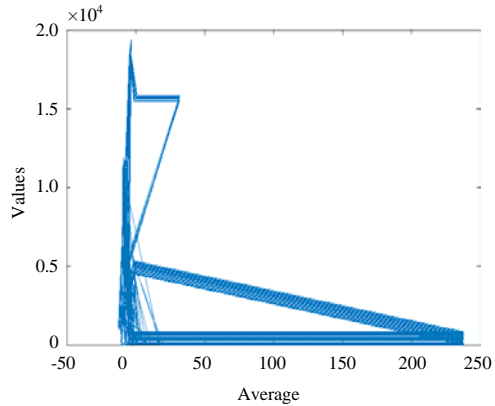


Fig. 5: Lock time vs. CMC average

We have taken these plots as a input signal and written code in the form of FFT program to convert time domain into frequency domain. After executing these FFT program in MATLAB Software, we got the plot which is given below. The FFT can be implemented by using the window functions in the FIR and IIR filters.

CONCLUSION

In this study, signal quality and carrier phase related for carrier phase error and amplitude for multipath to be estimated. Theoretically multipath parameters estimated and mitigation techniques of multipath to be analyzed.

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